

Final Report for NAG5-100

This document is a final technical report for grant NAG5-100, entitled "Research in X-ray Astronomy", which expired on June 30, 1997.

This research grant supported an active sounding rocket program at Penn State University over a period of over 10 years. During this period, the grant supported at least 8 graduate students in Astronomy & Astrophysics for at least a portion of their research. During the same period, our group was involved in seven sounding rocket flights, launched from White Sands, New Mexico, and from Woomera, Australia.

Most of these rocket flights, and most of the work supported by this grant, involved the use of X-ray CCD cameras. The first X-ray CCD camera ever flown in space was our sounding rocket observation of SN1987A (flight 36.030 in 1987). Subsequent flights utilized improved CCD detectors, culminating in the state-of-the-art EEV detector developed for our CUBIC mission, which was flown on 36.093 last May. Data from the last three flights, which observed the diffuse X-ray background with CCDs, include detection of the OVII He α line in the high latitude diffuse background (36.092, Fig. 1) and detection of the Mg XI He α line in the North Polar Spur (36.092, Fig. 2). These results have been reported at meetings of the American Astronomical Society (Mendenhall *et al.* 1996, *Bull. AAS*, 28, 1283) and the SPIE (Mendenhall *et al.* 1996, *Proc. SPIE*, 2808, 34). The analysis of flights 36.092 and 36.106 is part of Jeff Mendenhall's PhD thesis (PSU, 1998) and will be published in the *Astrophysical Journal* next year. The 36.093 data are currently being analyzed by PhD student Laura Cawley.

From 1990 to 1996 this grant supported our development and launch of the CUBIC instrument on the SAC-B satellite, which was designed to measure the spectrum of the soft X-ray diffuse background with moderate energy resolution and high S/N ratio. Unfortunately, this mission terminated shortly after launch due to a failure of the Pegasus XL launch vehicle. This work resulted in publication of 4 papers in the SPIE Proceedings and four others in refereed journals, in addition to several other conference proceedings and contributed papers.

In addition to the CCD flights described above, this grant has supported preliminary development of a new sounding rocket payload utilizing a replicated Ni mirror that is being developed at PSU in collaboration with MSFC. Initial testing of the coating technology has produced promising results.

The work carried out under grant NAG5-100 is now being continued under a new grant number, NAG5-5093.

Typical Diffuse Background Region (36.092 UH)

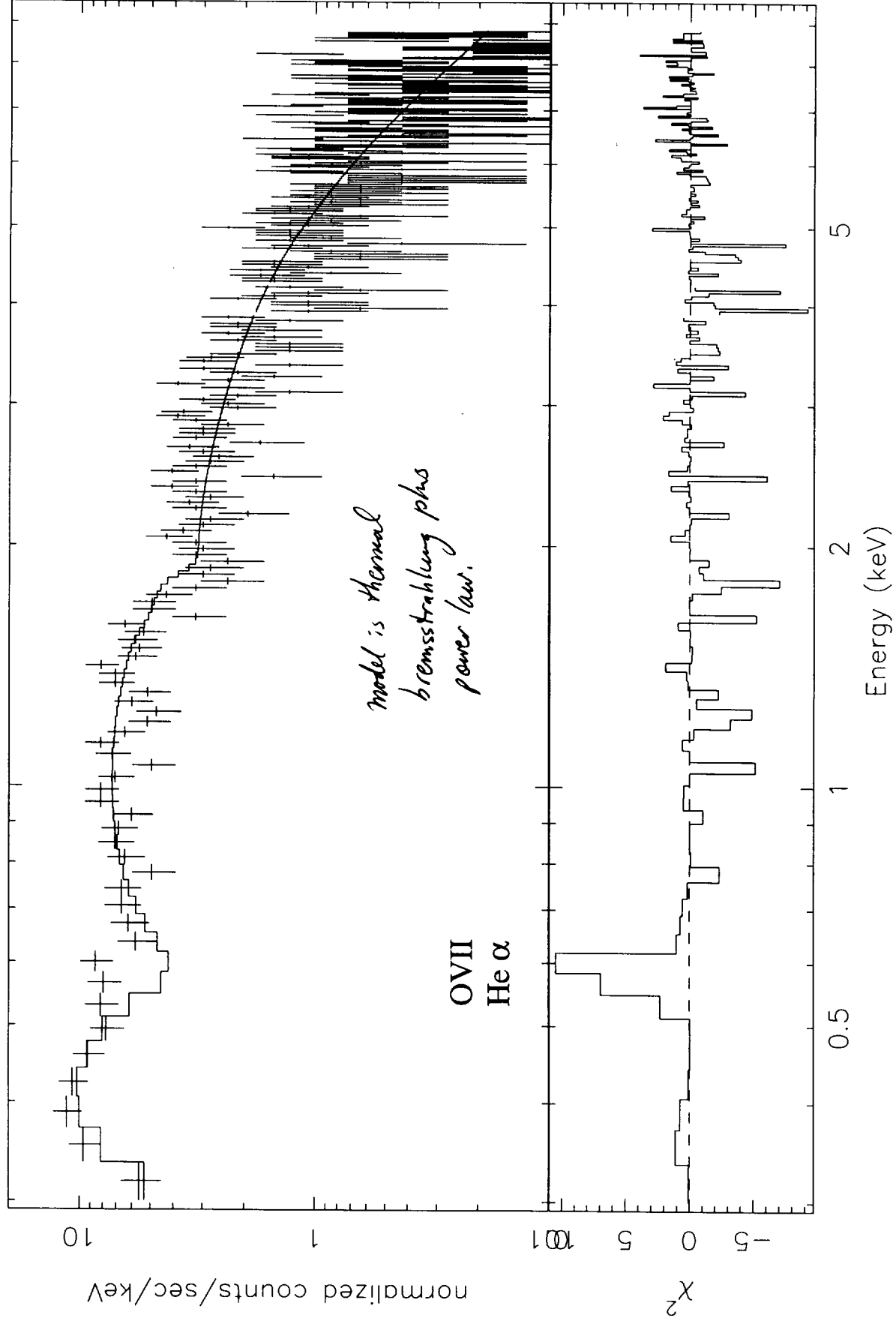


Fig. 1

The North Polar Spur (36,093 uH)

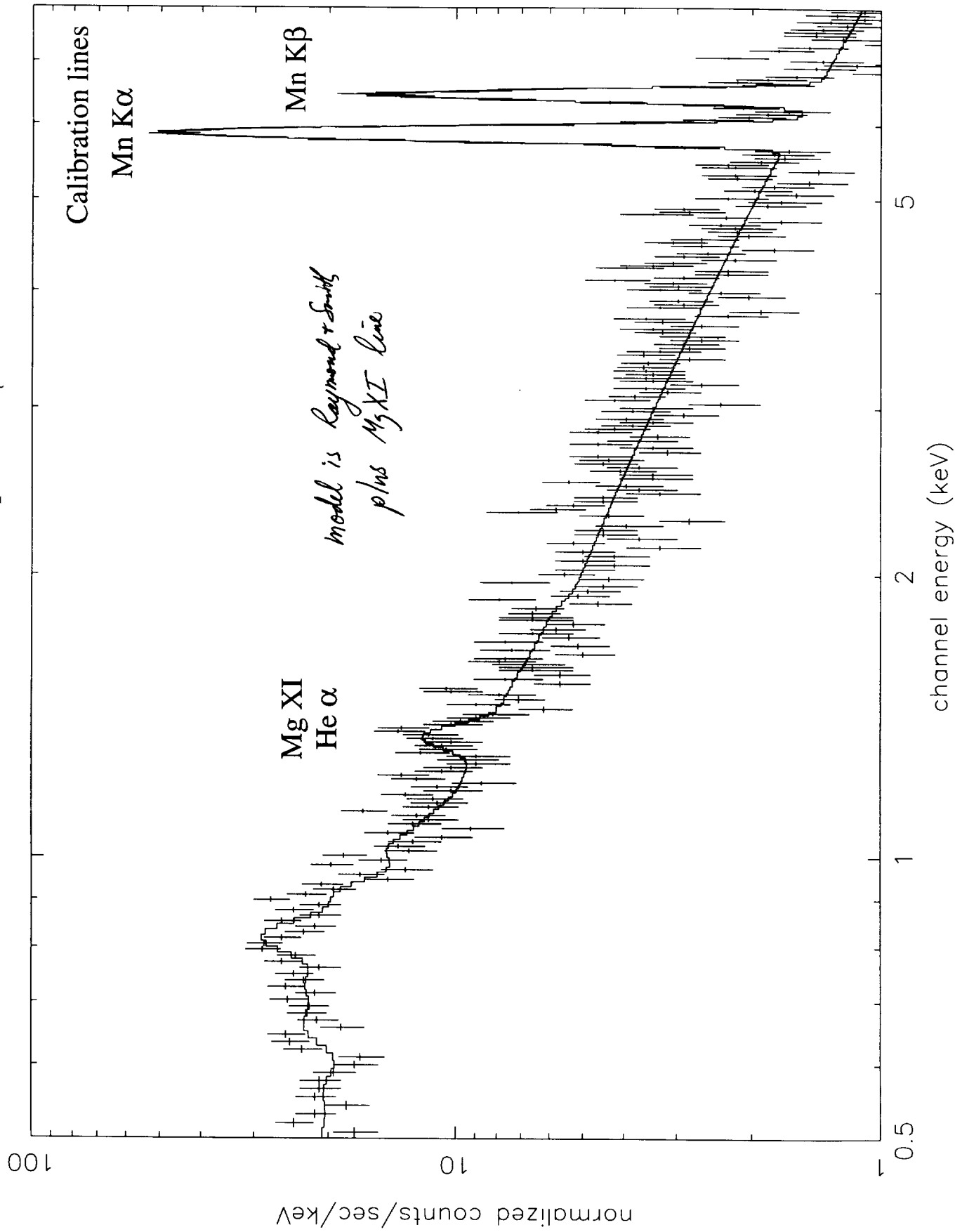


Fig. 7

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